

CLAIMS

1. An oxygen generation system comprising

(a) a portable oxygen generator unit comprising a portable air separation device for the generation of an oxygen-rich gas, a primary gas pump including means to supply air to the portable air separation device, a primary motor to drive the gas pump, a rechargeable power supply to drive the motor, connector means adapted to deliver power to the rechargeable power supply, flow coupling means to transfer the oxygen-rich gas from the portable oxygen generator unit, and a first oxygen-rich gas product discharge port; and

(b) a stationary base unit adapted to couple with the portable oxygen generator unit, wherein the stationary base unit comprises a stationary power supply system including connector means adapted to recharge the rechargeable power supply in the portable oxygen generator unit, flow coupling means to receive the oxygen-rich gas from the portable oxygen generator unit, and a second oxygen-rich gas product discharge port.

2. The system of Claim 1 wherein the portable oxygen generator unit is capable of operating independently in an uncoupled mode and supplying the oxygen-rich gas product at a first flow rate to a user via a cannula attached to the first discharge port.

3. The system of Claim 1 wherein the portable oxygen generator unit and the stationary base unit are capable of operating in tandem in a coupled mode and supplying the oxygen-rich gas product at a second flow rate to a user via a cannula attached to the second discharge port, and wherein the second flow rate is greater than the first flow rate.

4. The system of Claim 1 wherein the primary gas pump further includes means to withdraw gas from the portable air separation device.

5. The system of Claim 4 wherein the primary gas pump includes a feed gas compressor and a waste gas compressor, both of which are driven by the primary motor.

6. The system of Claim 1 wherein the stationary base unit includes a booster motor and a first drive coupling means integrated with the booster motor, the portable oxygen generator unit includes a second drive coupling means integrated with the primary motor, and the booster motor and primary motor are adapted to operate in tandem and drive the primary gas pump when the stationary base unit is coupled with the portable oxygen generator unit.

7. The system of Claim 6 wherein the portable air separation device is sized to generate 0.5 to 5 LPM of oxygen-rich gas, the primary gas pump is sized to provide sufficient air for the portable air separation device to generate 0.5 to 5 LPM of oxygen-rich gas, the primary motor is sized to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, and the booster motor is sized so that together with the primary motor, the booster motor is able to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 3 to 5 LPM of oxygen-rich gas.

8. The system of Claim 6 wherein the primary gas pump includes means to withdraw gas from the portable air separation device.

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9. The system of Claim 1 wherein the stationary base unit includes a stationary drive motor and a first drive coupling means integrated with the stationary drive motor, the portable oxygen generator unit includes a second drive coupling means integrated with the primary gas pump, and the stationary drive motor is adapted to drive the primary gas pump when the stationary base unit is coupled with the portable oxygen generator unit.

10. The system of Claim 9 wherein the portable air separation device is sized to generate 0.5 to 5 LPM of oxygen-rich gas, the primary gas pump is sized to provide sufficient air for the portable air separation device to generate 0.5 to 5 LPM of oxygen-rich gas, the primary motor is sized to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, and

the stationary drive motor is sized to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 5 LPM of oxygen-rich gas.

5 11. The system of Claim 9 wherein the primary gas pump includes means to withdraw gas from the portable air separation device.

10 12. The system of Claim 1 wherein the stationary base unit includes a secondary gas pump, a stationary drive motor to drive the secondary gas pump, and a gas export line from the secondary gas pump; wherein the portable oxygen generator unit includes a gas import line in flow communication with the portable air separation device; and wherein the gas export line and gas import line each have flow coupling means that can be coupled such that the secondary gas pump can provide a portion of the air to the portable air separation device when the stationary base unit is coupled with the portable oxygen generator unit.

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13. The system of Claim 12 wherein the portable air separation device is sized to generate 0.5 to 5 LPM of oxygen-rich gas, the primary gas pump is sized to provide sufficient air for the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, the primary motor is sized to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, the secondary gas pump is sized so that in tandem with the primary gas pump the two pumps can provide sufficient air to the portable air separation device to generate up to 5 LPM of oxygen-rich gas, and the stationary drive motor is sized to drive the secondary gas pump so that in tandem with the primary gas pump the two pumps can provide sufficient air to the portable air separation device to generate up to 5 LPM of oxygen-rich gas.

14. The system of Claim 12 wherein the primary gas pump includes means to withdraw gas from the portable air separation device and the secondary gas pump includes means to withdraw gas from the portable air separation device.

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15. The system of Claim 1 wherein the stationary base unit includes a secondary gas pump, a stationary drive motor to drive the secondary gas pump, and a gas export line from the secondary gas pump; wherein the portable oxygen generator unit includes a gas import line in flow communication with the portable air separation device; and
- 5 wherein the gas export line and gas import line each have flow coupling means that can be coupled such that the secondary gas pump can provide all of the air to the portable air separation device when the stationary base unit is coupled with the portable oxygen generator unit.
- 10 16. The system of Claim 15 wherein the portable air separation device is sized to generate 0.5 to 5 LPM of oxygen-rich gas, the primary gas pump is sized to provide sufficient air for the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, the primary motor is sized to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, the
- 15 secondary gas pump is sized to provide sufficient air to the portable air separation device to generate 0.5 to 5 LPM of oxygen-rich gas, and the stationary drive motor is sized to drive the secondary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 5 LPM of oxygen-rich gas.
- 20 17. The system of Claim 15 wherein the primary gas pump includes means to withdraw gas from the portable air separation device and the secondary gas pump includes means to withdraw gas from the portable air separation device.
- 25 18. The system of Claim 1 wherein the stationary base unit includes a stationary air separation device for the generation of a supplemental oxygen-enriched gas, a stationary gas pump including means to supply air to the stationary air separation device, a motor to drive the stationary gas pump, and piping means to combine the supplemental oxygen-rich gas with the oxygen-rich gas from the portable oxygen generator unit when the stationary base unit is coupled with the portable oxygen
- 30 generator unit.

19. The system of Claim 18 wherein the portable air separation device is sized to generate 0.5 to 3 LPM of oxygen-rich gas, the primary gas pump is sized to provide sufficient air for the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, the primary motor is sized to drive the primary gas pump to provide sufficient air to the portable air separation device to generate 0.5 to 3 LPM of oxygen-rich gas, the secondary gas pump is sized to provide sufficient air to the stationary air separation device to generate 0 to 7 LPM of oxygen-rich gas, and the stationary drive motor is sized to drive the secondary gas pump to provide sufficient air to the stationary air separation device to generate 0 to 7 LPM of oxygen-rich gas.

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20. The system of Claim 18 wherein the primary gas pump includes means to withdraw gas from the portable air separation device and the secondary gas pump includes means to withdraw gas from the stationary air separation device.

15 21. The system of Claim 1 wherein the portable oxygen generator unit further comprises a product storage tank for the oxygen-rich gas product.

22. The system of Claim 2 wherein the portable oxygen generator unit further comprises a conserver adapted to regulate the flow of oxygen-rich gas product supplied to the user by the cannula attached to the first discharge port.

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23. The system of Claim 3 wherein the stationary base unit further comprises a conserver adapted to regulate the flow of oxygen-rich gas product supplied to the user by the cannula attached to the second discharge port.

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24. The system of Claim 1 wherein the portable air separation device comprises a pressure swing adsorption system.

25. The system of Claim 18 wherein the stationary air separation device comprises a pressure swing adsorption system.

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26. The system of Claim 1 wherein the stationary base unit further comprises a humidifier adapted to add moisture to the oxygen-rich gas product.

5 27. The system of Claim 1 wherein the stationary base unit further comprises a spare rechargeable power supply and means to recharge the spare rechargeable power supply.

10 28. The system of Claim 1 wherein the rechargeable power supply is a rechargeable battery.

15 29. The system of Claim 28 wherein the stationary power supply system comprises an AC to DC power converter and a DC battery charger adapted to recharge the rechargeable battery.

30. The system of Claim 1 wherein the portable air separation device further comprises a power connector to receive DC power from an external source.

20 31. The system of Claim 1 wherein the rechargeable power supply is a portable fuel cell system comprising a fuel cell and portable fuel storage means.

32. The system of Claim 31 wherein the fuel is hydrogen or methanol.

25 33. The system of Claim 31 wherein the stationary power supply system comprises a stationary fuel cell system, stationary fuel storage means, and piping and connector means to transfer fuel to the portable fuel storage means when the stationary base unit is coupled with the portable oxygen generator unit.

34. The system of Claim 33 wherein the fuel is hydrogen or methanol.

35. A method to generate an oxygen-rich gas product comprising

(a) providing a portable oxygen generator unit comprising a portable air separation device for the generation of an oxygen-rich gas, a primary gas pump including means to supply air to the portable air separation device, a primary motor to drive the gas pump, a rechargeable power supply to drive the motor, connector means adapted to receive power to recharge the rechargeable power supply in the portable oxygen generator unit, flow coupling means to transfer the oxygen-rich gas from the portable oxygen generator unit, and a first oxygen-rich gas product discharge port;

(b) providing a stationary base unit adapted to couple with the portable oxygen generator unit, wherein the stationary base unit comprises a stationary power supply system including connector means adapted to supply power to recharge the rechargeable power supply in the portable oxygen generator unit, flow coupling means to receive oxygen-rich gas from the portable oxygen generator unit, and a second oxygen-rich gas product discharge port;

(c) operating the portable oxygen generator unit and the stationary base unit in an uncoupled mode wherein the portable oxygen generator unit is operated to separate air and provide the oxygen-rich gas product at a first flow rate to a user via a cannula attached to the first discharge port; and

(d) operating the portable oxygen generator unit and the stationary base unit in a coupled mode by

(1) coupling the portable oxygen generator unit and the stationary base unit by connecting the connector means and coupling the flow coupling means; and

(2) operating the portable oxygen generator unit to separate air and provide the oxygen-rich gas, transferring the oxygen-rich gas to the stationary base unit, and supplying the oxygen-rich gas product at a second flow rate to a user via a cannula attached to the second discharge port, and wherein the second flow rate is greater than the first flow rate.

36. The method of Claim 35 wherein the portable oxygen generator unit is operated in the uncoupled mode and generates the oxygen-rich gas product at a flow rate in the range of 0.5 to 3 LPM.

5 37. The method of Claim 35 wherein the portable oxygen generator unit and the stationary base unit are operated in the coupled mode and the coupled system generates the oxygen-rich gas product at a flow rate in the range of 0.5 to 5 LPM.

10 38. The method of Claim 35 wherein the stationary base unit includes a booster motor and a first drive coupling means integrated with the booster motor, the portable oxygen generator unit includes a second drive coupling means integrated with the primary motor, and the booster motor and primary motor are adapted to operate in tandem and drive the primary gas pump when the stationary base unit is coupled with the portable oxygen generator unit; and wherein the stationary base unit is coupled with the portable oxygen
15 generator unit and the booster motor and primary motor are operated in tandem to drive the primary gas pump and provide air to the portable air separation device.

20 39. The method of Claim 35 wherein the stationary base unit includes a stationary drive motor and a first drive coupling means integrated with the stationary drive motor, the portable oxygen generator unit includes a second drive coupling means integrated with the primary gas pump, and the stationary drive motor is adapted to drive the primary gas pump when the stationary base unit is coupled with the portable oxygen generator unit, and wherein the primary gas pump is driven only by the stationary drive motor to provide the air to the portable air separation device.

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40. The method of Claim 35 wherein the stationary base unit includes a secondary gas pump, a stationary drive motor to drive the secondary gas pump, and a gas export line from the secondary gas pump, the portable oxygen generator unit includes a gas import line in flow communication with the portable air separation device, and the gas export
30 line and gas import line each have flow coupling means that can be connected such that the secondary gas pump can provide a portion of the air to the portable air separation device when the stationary base unit is coupled with the portable oxygen generator unit;

and wherein the stationary base unit is coupled with the portable oxygen generator unit and the primary and secondary gas pumps are operated together to provide the air to the portable air separation device.

5 41. The method of Claim 35 wherein the stationary base unit includes a secondary gas pump, a stationary drive motor to drive the secondary gas pump, and a gas export line from the secondary gas pump, the portable oxygen generator unit includes a gas import line in flow communication with the portable air separation device, and the gas export line and gas import line each have flow coupling means that can be coupled such that
10 the secondary gas pump can provide all of the air to the portable air separation device when the stationary base unit is coupled with the portable oxygen generator unit; and wherein the stationary base unit is coupled with the portable oxygen generator unit and the secondary gas pump is operated to provide all of the air to the portable air separation device.

15 42. The method of Claim 35 wherein the stationary base unit includes a stationary air separation device for the generation of a supplemental oxygen-enriched gas, a stationary gas pump including means to supply air to the stationary air separation device, a motor to drive the stationary gas pump, and piping means to combine the
20 supplemental oxygen-rich gas with the oxygen-rich gas from the portable oxygen generator unit when the stationary base unit is coupled with the portable oxygen generator unit; and wherein the stationary base unit is coupled with the portable oxygen generator unit, and the oxygen-enriched gas and the supplemental oxygen-enriched gas are combined to provide the oxygen-rich gas product to the second cannula.

25 43. The method of Claim 35 wherein the oxygen-rich product gas contains greater than 85 mole % oxygen.

30 44. The method of Claim 35 wherein the primary motor is driven by externally-provided DC power when the portable oxygen generation unit is operated in the uncoupled mode.

45. An oxygen generation system comprising

(a) a portable oxygen generator unit comprising a portable air separation device for the generation of oxygen-rich gas, a primary gas pump including means to supply air to the portable air separation device, a primary motor to drive the gas pump, a rechargeable power supply to drive the motor, connector means adapted to deliver power to the rechargeable power supply, and an oxygen-rich gas product discharge port, wherein the portable oxygen generation unit is adapted to operate in a portable mode and generate a first flow rate of oxygen-rich gas; and

(b) a stationary base unit adapted to couple with the portable oxygen generator unit, wherein the stationary base unit comprises a stationary power supply system including connector means adapted to recharge the rechargeable power supply in the portable oxygen generator unit;

wherein the portable oxygen generator unit and the stationary base unit each include a first flow coupling means adapted to transfer oxygen-rich gas from the portable oxygen generator unit to the stationary base unit and a second flow coupling means adapted to transfer oxygen-rich gas from the stationary base unit to the portable oxygen generator unit, and wherein the stationary base unit and the portable oxygen generator unit are adapted to operate together in a coupled mode to generate oxygen-rich gas at a second flow rate that is greater than the first flow rate.

46. The system of Claim 45 wherein the portable oxygen generator unit is adapted to supply oxygen-rich gas product to a user via a cannula attached to the product discharge port.

47. The system of Claim 45 wherein the stationary base unit further comprises a humidifier adapted to add moisture to the oxygen-rich gas product.

48. The system of Claim 47 wherein the stationary base unit is coupled with the portable oxygen generator unit and wherein the stationary base unit and the portable oxygen

generator unit are adapted to provide humidified oxygen-rich product gas to a user via a cannula attached to the product discharge port on the portable oxygen generator unit.

49. A method to generate an oxygen-rich gas product comprising

5 (a) providing a portable oxygen generator unit comprising a portable air separation device for the generation of oxygen-rich gas, a primary gas pump including means to supply air to the portable air separation device, a primary motor to drive the gas pump, a rechargeable power supply to drive the motor, connector means adapted to receive power to recharge the rechargeable power supply, and an oxygen-rich gas product discharge port;

10 (b) providing a stationary base unit adapted to couple with the portable oxygen generator unit, wherein the stationary base unit comprises a stationary power supply system including connector means adapted to recharge the rechargeable power supply in the portable oxygen generator unit and means to humidify oxygen-rich gas, and wherein the portable oxygen generator unit and the stationary base unit each include first coupling means adapted to transfer oxygen-rich gas from the portable oxygen generator unit to the stationary base unit and second coupling means adapted to transfer oxygen-rich gas from the stationary base unit to the portable oxygen generator unit;

20 (c) operating the portable oxygen generator unit and the stationary base unit in an uncoupled mode wherein the portable oxygen generator unit is operated to separate air and provide an oxygen-rich gas product gas at a first flow rate of oxygen-rich gas to a user via a cannula attached to the product discharge port; and

25 (d) operating the portable oxygen generator unit and the stationary base unit in a coupled mode by

 (1) coupling the portable oxygen generator unit and the stationary base unit by connecting the connector means and coupling the first and second coupling means; and

30 (2) operating the portable oxygen generator unit to separate air and provide an oxygen-rich gas, transferring the oxygen-rich gas to the stationary base unit, humidifying the oxygen-rich gas to provide a

5 humidified oxygen-rich gas, transferring the humidified oxygen-rich gas to the portable oxygen generator unit, and supplying a humidified oxygen-rich gas product at a second flow rate of oxygen-rich gas to a user via the cannula attached to the discharge port on the portable oxygen generator unit, wherein the second flow rate is greater than the first flow rate.